Code No: **R1641033** **R16** **Set No. 1**

IV B.Tech I Semester Supplementary Examinations, February- 2020

FINITE ELEMENT METHODS

(Common to Mechanical Engineering and Automobile Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B

Answer ALL sub questions from Part-A

Answer any FOUR questions from Part-B

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PART–A *(14 Marks)*

1. a) Write the strain displacement [B] matrix for a 2-noded uniaxial bar element. [2]
   b) Write the properties of stiffness matrix. [3]
   c) Distinguish between truss and frame. [3]
   d) Write the shape functions for a triangular element. [2]
   e) Name any two 2-D elements used in FEM. [2]
   f) Write the heat conduction equation with constant thermal conductivity (k) and heat generation in two dimensions. [2]

PART–B *(4x14 = 56 Marks)*

2. a) For the spring assemblages shown in Fig.1, determine the nodal displacements, the forces in each element, and the reactions.

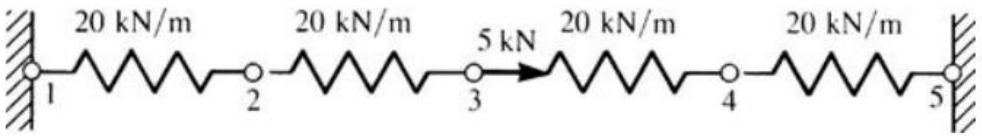


Fig.1 [8]

   b) Explain plane stress and plane strain conditions with examples. [6]

3. a) Write a note on discretization process and convergence criterion. [8]
   b) Explain
      (i) Natural co-ordinates (ii) area co-ordinates [6]

4. a) Derive the stiffness matrix of two node beam element. [10]
   b) Derive the load vector of UDL case for two node beam element. [4]

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5. a) Derive the strain displacement matrix of a 3 node triangular axisymmetric element. [7]
   b) Explain how axisymmetric analysis helps in reducing a three dimensional problem into two dimensional problem. [7]

6. a) Establish the shape functions for a four node quadrilateral element. [7]
   b) Evaluate the following integral by two point and three point quadrature between the limits -1 and +1 and compare the exact value. [7]

$$\int_{-1}^{+1} (2 + x + x^2)dx$$

7. a) For the composite wall shown in Fig.7(a) compute the interface temperatures considering three elements. Take K_1=5 W/m^{0}C, K_2=0.6 W/m^{0}C, K_1=20 W/m^{0}C, T_1=500^{0}C, T_4=100^{0}C [8]

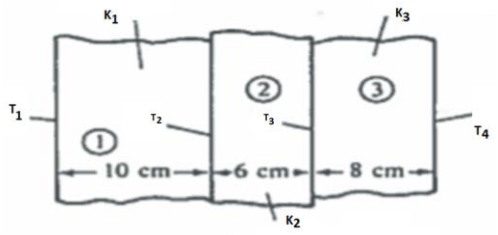


Fig.7(a)

   b) Explain the differences between consistent and lumped mass matrix. [6]

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